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THREE NEW LAND SNAILS FROM ISLA SANTA  
CRUZ (INDEFATIGABLE ISLAND), GALÁPAGOS

By

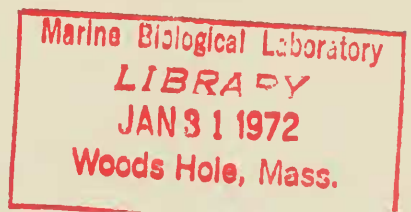
Allyn G. Smith

*Associate Curator, Department of Invertebrate Zoology, California Academy of Sciences*

From late January to early March, 1964, I had the opportunity to collect land snails on one of the larger of the Galápagos Islands as a participant in the Galápagos International Scientific Project (GISP). This expedition was sponsored by the University of California, the California Academy of Sciences through the Belvedere Scientific Fund, and the Charles Darwin Foundation. Assistance, both financial and material, was provided by the government of the Republic of Ecuador, the United States Navy, the National Science Foundation of the United States\*, the Shell Oil Company, and the California Maritime Commission whose training vessel, the *Golden Bear*, provided transportation of personnel and equipment to and from the Galápagos.

The major portion of the five weeks in the Galápagos Islands was spent in collecting on Isla Santa Cruz (Indefatigable). The decision to concentrate on this island was made for several reasons. First, it is large, high, and well forested, containing all of the life zones occurring in the Galápagos group; second, the Darwin Research Laboratory close to the village of Academy Bay made an ideal headquarters; and third, the well developed trail from Academy Bay into the highland area, which was pioneered by the members of the California Academy's 1932 Expedition sponsored by Templeton Crocker, cut through all life zones and made good collecting spots accessible (see map, fig. 1). These reasons fortunately tied in with the fact that the late winter and spring of 1964 proved to be a good time to find land snails on Isla Santa Cruz. There was considerable

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FIGURE 1. Outline map of Isla Santa Cruz (Indefatigable Island), Galápagos Islands, with some of the principal features sketched in.

rainfall, even in the Arid Zone along the shores of the island, which promoted snail activity.

The collections made through personal efforts were considerably augmented by other GISP scientists during their field work on other islands as well as Santa Cruz. To these appreciation is due. In addition, special thanks go to André and Jacqueline De Roy, a Belgian couple living at Academy Bay, for much pertinent information on possible productive collecting areas. Although not an active conchologist like his wife, M. De Roy became interested in the species of land snails to be found on his island and has made a number of special trips into uncollected areas in the highlands of Isla Santa Cruz in the past several years with signal success.

The following new species discovered as a result of these efforts make a significant addition to the land snail fauna of the Galápagos. The symbols "CASG" and "CASIZ" represent separate collections maintained by the Califor-

nia Academy of Sciences' Geology and Invertebrate Zoology departments, respectively, the latter consisting mainly of specimens preserved in alcohol.

***Naesiotus deroyi*** A. G. Smith, new species.

(Figures 2-9.)

**DESCRIPTION.** Shell fairly large for the genus, elongate-conic, yellowish white at the apex graduating to pure white on the body whorl. Whorls about 7, gently rounded, the sutures well impressed. Aperture subquadrate, with 2 prominent denticles, the first a strong, rounded boss on the columella, and the second a less strong, somewhat laterally compressed, subtriangular, parietal denticle positioned a short distance behind the plane of the aperture. Peristome thickened slightly but not reflected except on the basal portion, which partly covers a small shallow umbilicus. The peritreme is completed by a fairly heavy wash of callus. The columellar axis is simple, solid, and only slightly twisted. (See fig. 4.)

Nuclear whorls  $2\frac{1}{2}$ , erect, sculptured by many fine, closely spaced, occasionally anastomosing, slightly sinuate and protractive transverse lirae. The first postnuclear whorl is relatively smooth and marked by hardly noticeable lines of growth. Beginning with the second postnuclear whorl, a rough irregular but generally transverse wrinkling appears, becoming very heavy, somewhat warty, and more or less patternless on the penultimate and especially on the body whorl. Underlying this strong wrinkled sculpture are fine, closely spaced, spiral lirae, also beginning on the second postnuclear whorl, but not overriding the raised areas forming the wrinkles.

The animals, in alcohol, are yellowish white in color with no apparent special markings on the mantles. Unfortunately, I did not see specimens alive.

**HOLOTYPE.** An adult shell (CASG Type Collection, no. 13730) with animal in alcohol (CASIZ Type Series, no. 466), the shell measuring: height, 19.8; maximum diameter, 12.0; height of aperture, 8.8; maximum width of aperture, 7.6 mm. Number of whorls,  $6\frac{3}{4}$ . The apical angle of the spire is about  $50^\circ$ . (See figs. 2, 3.)

**PARATYPES.** Seventy-two specimens collected with the holotype. These have been deposited in various museums having recognized type collections, including the CASIZ Type Series, and in several private collections.

**TYPE LOCALITY.** Isla Santa Cruz (Indefatigable Island), Galápagos, on the northwest side at an elevation of about 264 m. (870 ft.), on a species of thorny bush (locally called "mora," the botanical name not available) by André De Roy, 18 February 1964.

**OTHER MATERIAL EXAMINED (ALL FROM ISLA SANTA CRUZ).**

(1) Three adult specimens (CASG no. 40129) found in a locality "1-2 hours walk west of the Horneman Farm,"—at an elevation of about 200 m. (650 ft.).



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FIGURE 2. *Naesiotus deroyi* A. G. Smith, new species. Holotype. Height, 19.8 mm. Apertural view. CASG Type Collection, no. 13730. FIGURE 3. Same. Back view. FIGURE 4. Same. Shell with cut-away section to show configuration of columella. Paratype. Height, 18.1 mm. CASG Type Collection, no. 13731. FIGURE 5. *Naesiotus* cf. *N. deroyi*. Adult

These were the first ones found by André and Jacqueline De Roy in 1963 in the same general area as the type lot collected in 1964. Others are in the De Roy Collection.

(2) Six adult shells, typical (CASG no. 40076), collected on the trail 6 miles to the west of the village of Bella Vista, on bushes, by André De Roy, 10 June 1964.

(3) One typical but rather small subadult (CASG no. 40302), collected in an area to the north of the central chain of craters well north and slightly west of the village of Santa Rosa, on the ground in a dense forest of *Scalesia pedunculata*, by André De Roy, 26 November 1966.

(4) One juvenile (CASG no. 40122), collected 5 miles northwest of Bella Vista, on "mora," at about 265 m. (870 ft.) elevation by André De Roy, 18 February 1964.

(5) Three rather small adults (CASG no. 40225), collected on the north side of the hill nearest to Santa Rosa Spring, on grass in a grassy glade, 200 m. (650 ft.) elevation, by André De Roy, 29 June 1965.

(6) Fourteen adults and subadults (CASG no. 40022), found 2 km. north-east of the village of Santa Rosa, on the ground, by André and Jacqueline De Roy, 28 June 1965. This series is not typical.

(7) Seven specimens (mostly subadults) preserved in alcohol (CASIZ Coll.), taken about 2 km. northeast of Santa Rosa, in open *Scalesia* forest hanging on the leaves of various plants and bushes, by André De Roy, 27 November 1966. This and the preceding lot are similar.

REMARKS. This is one of the largest and most strikingly sculptured of the Galápagos species of *Naesiotus*. No species closely similar has been described. While an average specimen is about 20 mm. high, with 7 whorls or slightly less, an unusually large one may be as much as 23 mm. in height, with the whorls numbering  $7\frac{1}{4}$  to  $7\frac{1}{2}$ . It appears to be a terminal species in the group of Galápagos snails that have developed a heavily wrinkled sculpture on nearly all of the postnuclear whorls rather than on the last portion of the body whorl, which

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shell from lot no. 6 with weaker wrinkled sculpture. Hypotype. Height, 17.4 mm. CASG Type Collection, no. 13733. Apertural view. FIGURE 6. Same. Back view. FIGURE 7. *Naesiotus deroysi*. Adult shell from lot no. 5. Hypotype. Height, 17.5 mm. CASG Type Collection, no. 13734. Apertural view. FIGURE 8. Same. Back view. FIGURE 9. Galápagos *Naesiotus* related to *N. deroysi*. Left to right: *N. rabidensis* (Dall, 1917) from Isla Rabida (Jervis Island), hypotype, height, 13.5 mm. (CASG Type Collection, no. 13735); *N. sculpturatus* (Pfeiffer, 1846) from Isla Santiago (James Island), hypotype, height, 13.6 mm. (CASG Type Collection, no. 13736); *N. darwini* (Pfeiffer, 1846) from the same island, hypotype, height, 15.9 mm. (CASG Type Collection, no. 13737); *N. deroysi*, holotype, fig. 2.

is the type of sculpture on such species as *Naesiotus lycodus* (Dall, 1917), *N. ochsneri* (Dall, 1917), and several others. So far, *N. deroyi* has been collected in the highland area of Isla Santa Cruz, only toward the northwest side of the island; it seems to prefer the moister forested area characterizing the *Scalesia* Zone. The nearest relative is *Naesiotus darwini* (Pfeiffer, 1846) from James Island, which is smaller, chunkier, and has a finer and much less rude type of wrinkled sculpture. Other species in the group include *N. sculpturatus* (Pfeiffer, 1846) from James Island, and *N. rabidensis* (Dall, 1917) from Jervis. (See fig. 9.)

Snails from lots 6 and 7 listed under "other material examined" come from the same general locality as the others. However, they are smaller in size than those from the type locality, averaging 17.1 mm. in height, with a range of 15.7–17.6 mm. Color is a light yellow-brown and all shells have a narrow, darker brown band encircling the periphery of the whorls; many have the entire base tinged with the same brown color. The wrinkled sculpture is much less strong, some shells having smooth patches with no wrinkles at all. (See figs. 5, 6.) As in some other Galápagos snail species, this particular population evidently represents an evolutionary trend of recent origin. Whether a subspecies is in the process of development is difficult to say until the range limits of both forms can be determined and other related factors studied. At present, it seems sufficient to call attention to the occurrence of another race closely allied to *N. deroyi*.

It is with considerable satisfaction that I take this opportunity to name a striking new species of Galápagos land snail for M. André De Roy, who collected the first specimens as well as the type and other lots.

***Naesiotus cavagnaroi*** A. G. Smith, new species.

(Figures 10–18.)

DESCRIPTION. Shell fairly large for the genus, smooth, broadly elongate-conic, with a fairly heavy texture and a tumid body whorl. Normal color pattern is reddish brown to chocolate brown with a narrow yellowish band coloring the sutures of the postnuclear whorls and encircling the body whorl slightly below its periphery. Whorls about  $6\frac{1}{2}$ , rounded, the sutures impressed. Aperture ovate, white inside, with 2 well developed denticles, the first an elongate, rounded swelling on the columella, the second one smaller, arcuate, and parietal, set well inside the retractive plane of the aperture and forming a U-shaped bay with the columellar denticle. Peritreme rather sharp, thinned down toward its edge, not reflected, the outside edge yellowish in color. The peritreme is completed by a heavy layer of callus, especially in older shells. There is a small shallow umbilicus partly covered by the basal reflection of the peristome. The columella is simple and only slightly twisted.

Nuclear whorls about two, dimpled, appearing smooth to the naked eye but

under magnification revealing a sculpture of extremely fine, closely spaced, transverse lirations that are slightly sinuate and beaded at their summits as a result of being cut by excessively fine spiral striae. Postnuclear whorls sculptured by lines of growth and very fine, closely spaced, spiral striations, the latter best seen under considerable magnification.

The surface of most shells exhibits a rather dull finish overall, with a tendency in some toward a more shining exterior. Occasional shells are yellowish in color with no suggestion of a revolving band. Animals in alcohol are tuberculate dorsally and light grey in color, there being no appreciable color difference between those occupying normally colored or xanthic shells.

**HOLOTYPE.** An adult shell preserved without the animal has been deposited in the CASG Type Collection, no. 13738. It measures: height, 22.7; maximum diameter, 13.9; height of aperture, 10.4; maximum width of aperture, 9.1 mm. Number of whorls,  $6\frac{1}{2}$ . Apical angle, about  $70^\circ$ . (See figs. 10, 11.)

**PARATYPES.** A total of 52 specimens collected with the holotype. Of this total 30 have adult shells, 17 are subadults, and 6 are juveniles. Of this same total, 10 have xanthic shells (6 adults, 3 subadults, and 1 juvenile). About half of the type lot were collected alive; animals with their shells of a few of both color forms have been preserved in alcohol. A distribution of these paratypes will be made in a manner similar to that indicated for the previously described species (*Naesiotus deroyi*).

**TYPE LOCALITY.** Isla Santa Cruz (Indefatigable Island), Galápagos, about 7 km. northeast of the farming village of Santa Rosa in the vicinity of a series of small volcanic craters in a *Scalesia* forest; collected under lava rocks and dead wood by André De Roy, 27 November 1966.

#### OTHER MATERIAL EXAMINED.

(1) Three dead, bleached, adult shells (CASG no. 40158) collected along the trail near the summit of Mt. Crocker at an elevation of 650–870 m. (2130–2850 ft.) by Robert L. Pyle, 25 February 1964.

(2) Seven dead, bleached, adult shells (CASG no. 40237) collected near an isolated rocky crater (subsequently designated as Cavagnaro Crater), in a *Scalesia* forest on the north slope of the island at an elevation of about 500 m. (1600 ft.) by David Q. Cavagnaro, 10 April 1964.

(3) One dead, bleached adult shell (CASG no. 40512) found about 0.5 mile below Santa Rosa on the trail from Bella Vista by André and Jacqueline De Roy, 1 March 1965.

(4) One dead but fresh adult shell, 1 subadult and 1 juvenile (CASG no. 40229) collected in the *Scalesia* forest near Cavagnaro Crater, elevation about 625 m. (2050 ft.), by André and Jacqueline De Roy, 2 March 1965.

(5) Sixty-two dead adult shells (CASG no. 40221) collected on the ground



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FIGURE 10. *Naesiotus cavagnaroi* A. G. Smith, new species. Holotype. Height, 22.7 mm. CASG Type Collection, no. 13738. Apertural view. FIGURE 11. Same. Back view. FIGURE



in the vicinity of Cavagnaro Crater, elevation about 690 m. (2200 ft.), by André and Jacqueline De Roy, 2 March 1965.

(6) One dead, bleached, adult shell (CASG no. 40228) collected on the ground near Santa Rosa school by André De Roy, 2 November 1965.

(7) One dead, bleached, adult shell (CASG no. 40234) collected 2 miles from the Santa Rosa school on the trail from Bella Vista, by André De Roy, 2 November 1965.

(8) Seven dead, bleached, adult shells (CASG no. 40295) collected in the vicinity of Cavagnaro Crater, by André De Roy, 23 November 1966.

(9) Three bleached "bones" (CASG no. 40300) collected in a small lava cave to the west of Chimney Mountain, by André De Roy, 25 November 1966.

(10) Thirty-eight adult shells, all xanthic (CASG no. 27537), collected "at the very top of the island" (*i.e.*, summit of Mt. Crocker) by Templeton Crocker, 10 or 11 May 1932.

(11) Forty-seven adult shells, all xanthic but darker in color than the preceding lot (CASG no. 27538), collected "on the trip to top of Mt.," by Templeton Crocker, 10 or 11 May 1932.

(12) Two adults and 1 juvenile with color pattern reversed taken alive half way between Chimney Mountain and Santa Rosa Spring under low bushes in an open area, elevation about 600 m. (1950 ft.), by André and Tui De Roy, 27 June 1965.

(13) Thirty-three mostly adult shells taken alive (CASG no. 43333; 15 in alcohol are CASIZ Collection) 2 miles west of Mt. Crocker at the foot of a volcanic crater on the ground among small trees, by André and Jacqueline De Roy, 10 May 1970.

REMARKS. This smooth brown snail with a yellowish revolving band has no close relatives of comparable size either on Isla Santa Cruz (Indefatigable Island) or on any of the other Galápagos Islands. Its range on Indefatigable is limited to the north slope of the island extending down from the summit of the

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12. Same. Shell with cut-away section to show configuration of columella. Paratype. Height, 22.0 mm. CASG Type Collection, no. 13739. FIGURE 13. Same. Xanthic color-phase, adult, from type lot. Paratype. Height, 21.2 mm. CASG Type Collection, no. 13740. FIGURE 14. Same. Xanthic shell, adult, with over-all greenish-brown color tone, from lot no. 11. Hypotype. Height, 23.1 mm. CASG Type Collection, no. 13741. Apertural view. FIGURE 15. Same. Back view. FIGURE 16. Same. Adult shell with color pattern reversed, from lot no. 12. Hypotype. Height, 18.8 mm. CASG Type Collection, no. 13742. FIGURE 17. Same. Adult shell with normal color pattern reversed, from lot no. 13. Hypotype. Height, 26.7 mm. CASG Type Collection, no. 13743. FIGURE 18. *Naesiotus duncanus* (Dall, 1893). Adult dead shell from Isla Pinzón (Duncan Island). Hypotype. Height, 18.7 mm. CASG Type Collection, no. 13744.

main volcanic crater, Mt. Crocker, generally in the *Scalesia* Zone, at elevations above 500 m. (1600 ft.). It is a ground snail, frequenting moist habitats under lava rocks, *Scalesia* dead-falls, or equivalent cover.

*Naesiotus cavagnaroi* is remarkably consistent in size and general configuration. Measurements of 15 adult shells from the type locality average 21.9 mm. in length and 13.4 mm. in maximum diameter, with about  $6\frac{1}{2}$  whorls. The corresponding range measurements for this series are 21.0–23.5 and 12.4–14.6, with the number of whorls ranging from  $5\frac{3}{4}$  to  $6\frac{1}{2}$ , the latter number being the most frequent. Young shells are prominently keeled at the base of the developing whorls.

The occurrence of xanthic shells along with normally colored ones is of particular interest. (See figs. 13–15.) No similar situation has been observed in any other Galápagos species of *Naesiotus*. According to André De Roy, who collected the type series, the ratio of xanthic to normally colored shells is about one to five, which is confirmed by the count of specimens sent by him for identification and study. There is no difference in the color of the animals and all xanthic shells seen fall within the range of measurements given above. Lot nos. 10 and 11 in the preceding list are all the bandless xanthic color form. They were collected by Templeton Crocker during the Academy's 1932 Galápagos Expedition at the time he and his party pioneered the first ascent of the island's main crater, later called Mt. Crocker in his honor. The series of shells he collected at the crater rim are of the same yellowish color as xanthic shells from the type locality of the species. The second lot, collected at a lower elevation on the way to the top, are darker in color with a greenish brown cast. Both of these lots evidently represent pure xanthic populations of the species; the exact localities where they were found are presently unknown and a search for them should be made.

The three specimens in lot no. 12 in the list of specimens examined have a color pattern that is the reverse of the normal one, being a light beige-brown overall with a dark brown encircling band. The two adult shells have red-brown nuclear whorls but in size and sculpture they are normal for the species. (See fig. 16.) Until recently this reverse color pattern was thought to be of rare occurrence, but an apparently pure colony of such shells was collected by the De Roes in the highland area in May 1970 (lot no. 13, preceding). Of the 33 shells sent in for study, 21 have the same reverse color pattern just mentioned except that the encircling brown band is bordered below by a whitish band of somewhat variable width (see fig. 17); 7 have weak or indistinct banding and thus approach the xanthic form; and 5 are similar to the xanthic shells occurring in the type lot. Compared with the type series, shells in this lot average slightly higher, several being a little longer spired with deeper sutures. The largest shell measures  $26.7 \times 14.5$  mm. in height and maximum diameter. Mme. De Roy's com-

ments on this lot (personal communication, 1 August 1970) are of such interest that they are repeated, as follows:

Surprisingly, we found them living in an area where André had collected before, only that he searched a couple of hundred yards on either side. In fact, the area where this colony of snails is living is restricted (?) to a brushy patch surrounded by grass-covered hills and may be no more than 3 or 4 acres. Snails there are quite abundant but this could change before long, as barbed-wire fence already divides the place in two lots and the land will be converted into pastures.

Although the reverse color phase may possibly turn out to be a different species when the relation between it and the color phase considered to be the normal one is better known, present indications are that there is only a single species involved, in spite of the fact that there are four color forms.

Two described Galápagos species have some superficial resemblance to *Naesiotus cavagnaroi*. One is *N. duncanus* (Dall, 1893) from Duncan Island (Isla Pinzón), shown in figure 18, which has the same general shape and number of whorls although it is considerably smaller in size, has a less well developed parietal denticle, and lacks the columellar thickening or flange present on *N. cavagnaroi*. Unfortunately, *N. duncanus* has not been reported as having been collected alive and may, in fact, be extinct. The other similar species is the rare *N. jervisensis* (Dall, 1917), which again is much smaller than *N. cavagnaroi*, has a less well developed parietal denticle and columellar flange, but has the same type of fine spiral sculpture: it differs, however, in having the last whorl irregularly corrugated and in being unicolored and unbanded.

The species is named for David Q. Cavagnaro, California Academy entomologist and a member of the GISP, who collected some of the first specimens and also a number of other land snails of considerable scientific value on Isla Santa Cruz and on several other Galápagos islands he was able to visit.

### ***Naesiotus scalesiana* A. G. Smith, new species.**

(Figures 19–25.)

DESCRIPTION. Shell of medium size for the genus, elongate to globose-conic, the apex rose-colored with the remaining shell whitish or tinged with beige, yellowish white, or very light red-brown. Whorls  $5\frac{1}{2}$  to  $6\frac{1}{2}$ , almost flat-sided, the sutures only moderately impressed. Aperture subovate, usually without denticles; the peristome thin and unflared, hardly reflected at the base of the columella, leaving open a small but permeable umbilicus, not joined across the parietal wall of the body whorl with any appreciably thickened wash of callus.

Nuclear whorls nearly 3, erect, sculptured with extremely fine, closely spaced, nearly straight transverse riblets or lirae, extending all the way across them. Postnuclear whorls somewhat shining, the first one or two with coarse, irregular lines of growth, later ones with additional, irregularly placed, rather deep indenta-



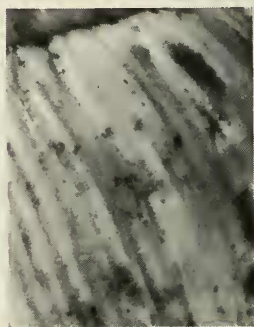
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FIGURE 19. *Naesiotus salesiana* A. G. Smith, new species. Holotype. Height, 14.1 mm. CASG Type Collection, no. 13745. FIGURE 20. Same. Back view. FIGURE 21. Same. Shell with cut-away section to show configuration of columella. Paratype. Height, 13.6 mm. CASG Type Collection, no. 13746. FIGURE 22. Same. Enlarged view of portion

tions and elongate impressions, which are most prominent on the body whorl.

Animals in alcohol generally yellowish white, occasionally tinged with light gray on the dorsal surface, the foot usually being of a slightly lighter color tone. Rarely, an animal is quite dark-colored. There appears to be no correlation between the color of the animal and the color of the shell.

**HOLOTYPE.** An adult shell measuring: height, 14.1; maximum diameter, 7.5; height of aperture, 6.4; width of aperture, 3.7 mm. Number of whorls,  $6\frac{1}{4}$ . Apical angle, about  $45^\circ$ . CASG Type Collection, no. 13745.

**PARATYPES.** Ninety-two additional specimens preserved dry, deposited in various museums maintaining type collections including the CASG Type Collection, and 4 preserved in alcohol in the CASIZ Type Series, no. 470.

**TYPE LOCALITY.** Isla Santa Cruz (Indefatigable Island), Galápagos Islands, in the *Scalesia* Zone, Horneman Farm area, at an elevation of about 244 m. (800 ft.), on *Scalesia* trees and tall bushes, collected by A. G. Smith, 19 February 1964.

**RANGE AND ECOLOGY.** A total of 36 separate lots, in addition to the type lot, have been collected and are available for study. All of these have contributed to the present consideration of the species. They represent over 500 specimens, mostly preserved dry, although a representative series of animals were drowned and preserved in alcohol in an expanded condition.

*Naesiotus scalesiana* seems to be the most prevalent species throughout the *Scalesia* Zone on Isla Cruz. Its occurrence most often on the trunks and branches of *Scalesia* trees makes the name given to it an appropriate one. This habitat is shared with *N. lycodus* (Dall, 1917), also pink-tipped but with a much more wrinkled shell, which is almost as common at the type locality although it does not climb as high up as *N. scalesiana*. The latter species has been collected also, though sparingly, at the upper edge of the Transition Zone and in the lower part of the *Miconia* Zone but it does not seem to thrive outside the areas occupied by the forests of *Scalesia pedunculata* wherever they occur under conditions of heavier rainfall and hence of moister conditions than exist in the lower or the higher, somewhat dryer life zones.

Along the "old" or original trail from Academy Bay village to the highland

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of holotype to show sculptural detail. **FIGURE 23.** Same. Group of five adult shells from *Scalesia* Zone below Bella Vista village, Isla Santa Cruz. Allyn G. Smith and Ira L. Wiggins, collectors, 19 February 1964. Hypotypes. Height (left-hand shell), 13.3 mm. CASG Type Collection, nos. 13747, 13747a, 13747b, 13747c, 13747d. From CASIZ Color Slide, no. 955. **FIGURE 24.** Same. Group of five adult shells from type lot. Holotype at left (height, 14.1 mm.); the rest paratypes, CASG Type Collection, nos. 13748, 13748a, 13748b, 13748c. From CASIZ Color Slide no. 1937.

area on Isla Santa Cruz, Dr. Ira L. Wiggins and I first encountered *N. scalesiana* in 1964 in the Transition Zone at an elevation of about 120 m. (400 ft.) (CASG no. 40083, 2 adult specimens). It became quite common at the lower end of the *Scalesia* Zone on young *Scalesia* trees, along with *N. lycodus*, and continued prevalent in the vicinity of the village of Bella Vista, the areas of the Horneman and Kastdalen Farms, and for a short distance into the *Miconia* Zone (CASG no. 40070, 3 adult specimens). Elsewhere in the *Scalesia* Zone M. André De Roy and others collected it toward the eastern side of the island in the Table Mountain area (CASG no. 40232), on the northern side in the general vicinity of Cavagnaro Crater (CASG no. 40221), around the village of Santa Rosa, and to the south of Santa Rosa near the end of the trail into the Tortoise Reserve at El Chato.

The *Scalesia* snail lives in more of an arboreal habitat than any other Galápagos land snail with which I am familiar. On one collecting trip, Dr. Wiggins and I decided to sacrifice one large *Scalesia* branch to see just how far up the snail might go. We found two living adults (CASG no. 40231) at the very tip of the branch, about 35 feet from the ground, among the small sunflower-like *Scalesia* blossoms in flower at the time. It does not confine itself entirely to *Scalesia* plants and trees, however, but has been collected living on *Darwiniothamnus*, a bush of medium height, and below Santa Rosa village in thickets of thorny shrubs called "mora" by the native Ecuadoreans in company with another new species of Galápagos land snail, *Naesiotus deroyi*, described earlier in this report.

Unfortunately, nothing is known at present of the breeding habits of the species; its egg clusters were not found in 1964 and have not been reported subsequently.

INDIVIDUAL VARIATION. The type lot of *N. scalesiana* was selected for general consistency in size and color of the shells, and also for the accessibility of the type locality at the Horneman Farm, making it relatively easy for topotypical material to be collected. Color in the type lot ranges from almost pure white to an overall suffusion of beige or light brown; only one adult shell in the series has darker postnuclear whorls, with a body whorl having a distinctly brown and white banded pattern. (See fig. 24.) The rose-colored tip is consistent within the type lot and for most of the other shells at hand.

Variation in size within the type lot is shown in the following table of measurements of 25 adult paratypes, selected more or less at random:

Item	Height (mm.)	Max. Diam. (mm.)	Apical Angle (°)	No. Whorls
Tallest shell	15.2	7.6	49	6¼
Shortest shell	11.5	6.2	51	5½
Avg. of 25	13.3	7.1	50	5¾



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FIGURE 25. *Naesiotus scalesiana*. Shell with living animal. Collected by Robert L. Usinger and Earl G. Linsley, Bella Vista village, 4 February 1964. Author's field photo taken at Academy Bay. From CASIZ Color Slide, no. 440.

Shells from other localities on the island have measurements that are consistent with the preceding figures. A few adult shells from the vicinity of Santa Rosa have slightly more tumid whorls and lack the usual rose-colored apex.

Most shells have simple apertures with no parietal or columellar denticles or denticular swellings; this is true of all specimens in the type lot and of others collected in the Horneman Farm area. A few shells from the general vicinity of Santa Rosa do have small to subobsolete parietal denticles, and in some but not all of these there are perceptible swellings on the columella where a columellar tooth would normally occur, were one present. Such denticular processes are not a character of this species although they are normal in the apertures of other species of *Naesiotus* from Isla Santa Cruz and other Galápagos Islands. Whether the rare occurrence of apertural denticulation represents an evolutionary trend toward development of prominent teeth in the aperture, or away from this, is a question that cannot be answered from the present sparse knowledge of the biology of the species and its probable ancestral relationships.

A well rounded body whorl is characteristic of *N. scalesiana*, although occa-

sionally an adult shell shows a barely perceptible angulation at its base near the periphery. As might be expected, this feature is seen more often on juvenile and subadult shells.

The indented sculpture on the body whorl is peculiar; it cannot be said to be malleate in terms of small, rounded hammer marks. Rather, it consists of pits in combination with elongated, sometimes anastomosing furrows that have the appearance of impressions made by a blunt point or an elongated, blunt edge. This type of sculpture varies somewhat in intensity between populations from which specimens have been collected. (See figs. 22, 25.) On the whole, however, the shells of *N. scalesiana* exhibit characters that are quite consistent throughout its range.

COMMENTS. It seems unusual that such an abundantly represented species of Galápagos land snail has escaped notice for so long a time. W. H. Dall did not recognize it as having been collected during earlier Galápagos expeditions; apparently neither Baur nor Wolf saw it. Reibisch (1892) reported nothing like it, his only large snail from Indefatigable Island (Isla Santa Cruz) being *Naesiotus wolffi*, an entirely different species which he described as new. It was not found by Snodgrass and Heller during the Hopkins-Stanford Expedition of 1897-98; nor was it collected by W. H. Ochsner during the California Academy's 1905-06 Expedition, which spent quite a little time at Academy Bay. The California Academy's 1932 Expedition did not find it even though in the first ascent to the rim of the main crater the party led by Templeton Crocker traversed the *Scalesia* Zone on the way to the top as well as on the way back. The United States National Museum has no specimens like it in its large representative collection of Galápagos land snails; however, it does possess a single adult specimen from an unidentified island, collected or obtained by Hugh Cuming, under the name *Bulimulus calvus* (Sowerby, 1833) (USNM no. 104,864) that is quite close to *Naesiotus scalesiana*. The first authentic collecting record known to me is a single shell found by Dr. Robert I. Bowman, "5 miles North of Academy Bay," March 2, 1953, at an elevation of 775 feet (CASG no. 34649). All shells collected subsequently were taken during the Galápagos International Scientific Project of 1964 and since.

*Naesiotus scalesiana* has no demonstrable relationship with any of the other 15 species of *Naesiotus* from Isla Santa Cruz, including the two previously described as new in this report. I have not seen shells like it from any of the other islands in the Galápagos Archipelago. Closest relatives would appear to be certain species of *Naesiotus* from the mainland of South America (Weyrauch, 1956, 1967) but lack of appropriate mainland material at the present writing places any detailed comparison beyond the scope of this discussion.



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